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**A-91-46**

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**ETHYL CORPORATION**  
Health and Environment Department

Donald R. Lynam, Ph.D.  
Director, Air Conservation  
and Industrial Hygiene

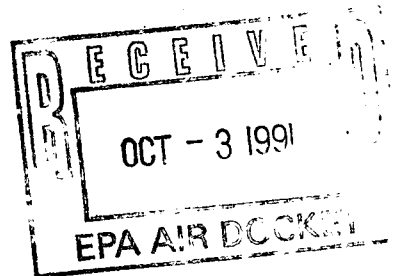
October 2, 1991

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451 Florida  
Baton Rouge, LA 70801  
504/388-8008  
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TELEX 586-441

OVERNIGHT MAIL

*EPA AIC Docket*  
*A-91-46*

Mr. David L. Kulp  
Manager, Fuel Economy  
Planning & Compliance  
Ford Motor Company  
The American Road  
Dearborn, Michigan 48121



Dear Mr. Kulp:

In accordance with your request for additional test data from the Ethyl test fleet, we are enclosing the data dropped from Ethyl data set 2S (136 data points) and 4S (151 data points). The Systems Applications, Inc. final report, entitled "Appendix 2A: Statistical Analysis of Automotive Exhaust Emissions in Support of Ethyl's HiTEC® 3000 Fuel Waiver application," May 4, 1990, and included in the May 9, 1990 Waiver Submission, includes a complete discussion of the data sets and data set generation in Section 2, Testing Program Data Base. The discussion of data set generation and description of data sets is attached (pages 10-15). The 136 data points dropped from Ethyl 2S are all tests invalid from an engineering point of view and therefore are considered justifiable drops. The 151 data points dropped from Ethyl 4S are the extra tests beyond the standard first two emission tests. The data sets are fully described in the SAI report. Please let us know if additional clarification is required.

We wanted to thank you for sending us the raw data from Ford Motor Company's ("Ford") recent test program on the HiTEC® 3000 performance additive. To aid us further in evaluating Ford's raw data, Ethyl would like to learn more about the Ford test program. In particular, we believe that the following information will be necessary for a meaningful evaluation of the data:

- Any available maintenance information in addition to that which was provided as part of the raw emission data sheets you provided to Ethyl. This would include information on both scheduled and unscheduled maintenance, reason for service, listing of components replaced and why the decision to replace was made.
- Identification of individual drivers for each emission test and for each test vehicle, including the process used to assign drivers to test vehicles.
- A description of the type and purpose of the test programs (including test protocols) on which the Additive testing was piggybacked.

Excerpt  
from

Final Report

APPENDIX 2A: STATISTICAL ANALYSIS OF  
AUTOMOTIVE EXHAUST EMISSIONS IN  
SUPPORT OF ETHYL'S HiTEC® 3000  
FUEL WAIVER APPLICATION

SYSAPP-90/037

May 4, 1990

Prepared for

Ethyl Petroleum Additives, Inc.  
20 South 4th Street  
St. Louis, Missouri 63102

Prepared by

Systems Applications, Inc.  
101 Lucas Valley Road  
San Rafael, California 94903

415/472-4011

-2-

- Listing of fuel batch numbers, fuel analysis and specifications, detergent, and other additives. Samples of test fuel, if available, would also be helpful.
- A detailed description of the Explorer "prototype" vehicle, including the thermactor being tested and purpose, and applicable emission standards calibration.
- Individual data on emission tests for CO, HC, NO<sub>x</sub>, particulates, and manganese obtained in the particulate cells as part of the particulate analysis, together with mileage test points, and dates of testing.
- Information on mileage accumulation shifts, including number of shifts per day, length of shifts, and the approximate total number of hours the vehicles are driven per day.
- Any data on the driveability of the test vehicles throughout the course of the test program.

In addition, once you have completed your ongoing test programs, we would appreciate information and data on any post mortem analyses of vehicle components, including catalysts, O<sub>2</sub> sensors, fuel injectors, and any other engine parts. We look forward to receiving more details about the Ford test program.

Sincerely,



Donald R. Lynam, Ph.D., CIH, PE  
Director, Air Conservation,  
Industrial Hygiene and Safety

DRL:cr

Enclosures

cc: Mary T. Smith

Field Operations and Support

229drl91

## DATA SET GENERATION

Special attention was given to the creation of the data sets for analysis. This step is important because it defines the information used in the statistical tests and its presentation in the waiver.

In 43 Federal Register 11258 (March 17, 1978) the EPA published a series of guidelines that apply to waiver applications for fuel additives under Section 211(f) of the Clean Air Act. In these guidelines the EPA states that "it is essential that test data provide a reliable basis for comparison with the conditions under which vehicles are certified pursuant to Section 206 of the Clean Air Act." Throughout this waiver program it has been generally assumed by Ethyl that the regulations that apply to the certification of new automobile models under the Clean Air Act would also apply to test programs for fuel waivers. For that reason, decisions on what data to include in the working data sets for analysis for this waiver application were based on the sections of the Code of Federal Regulations that pertain to certification and test procedures for exhaust emissions (40 CFR Part 86 as of January 31, 1990).

Because of the importance placed on those specific sections of the Code of Federal Regulations, we shall discuss several of the specific paragraphs that are relevant to this waiver application.

86.088-28(a)(4)(A) "The applicable results to be used unless excluded by paragraph (a)(4)(i)(A)(4) of this section in determining the exhaust emission deterioration factors for each engine-system combination shall be:

1. All valid exhaust emission data from the tests required under 86.084-26(a)(4) except the zero-mile tests.
2. All exhaust emission data from the tests conducted before and after the scheduled maintenance provided in 86.088-25.
3. All exhaust emission data from tests required by maintenance approved under 86.088-25, in those cases where the Administrator conditioned his approval for the performance of such maintenance on the inclusion of such data in the deterioration factor calculation.

4. The manufacturer has the option of applying an outlier test procedure to completed durability data.... The outlier procedure will be specified by the Administrator. For any pollutant, durability-data test points that are identified as outliers shall not be included in the determination of deterioration factors if the manufacturer has elected this option."

Comments: These paragraphs imply that all emissions test results except those associated with the zero-mile point and those conducted before unscheduled maintenance be used in the statistical analysis. This would include all results obtained before and after scheduled maintenance and after unscheduled maintenance. Examination of the data in the initial stages of analysis revealed no outliers, and so no tests were deleted as a result of an outlier test procedure.

86.084-26(a)(6)(i)(A) "The manufacturer may conduct multiple tests at any test point at which the data are intended to be used in the deterioration factor. At each test point where multiple tests are conducted, the test results from all valid tests shall be averaged to determine the data point to be used in the deterioration factor calculation except under paragraph (a)(6)(i)(B) of this section. The test results from emission tests performed before maintenance affecting emissions shall not be averaged with test results after the maintenance".

86.084-26(a)(6)(i)(B) "The manufacturer is not required to average multiple tests if the manufacturer conducts no more than three tests at each test point and if the number of tests at each test point is equal. All test points must be treated the same for all exhaust pollutants".

86.088-28(a)(4)(i)(B) "All applicable exhaust emission results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through all these data points".

Comments: The implication of the first two paragraphs is that the means for each car at each testing interval should be weighed equally. This assumes that the mean emissions for each individual vehicle is the same as that for all vehicles in the same model group on the same fuel. Therefore careful consideration must be given to those instances where there are a different number of tests per car per testing interval. When the design is balanced (i.e., the same number of tests for each vehicle at each testing interval), the same regression line will be predicted whether one uses all the data or just the averages (although confidence intervals will be

different). However, in a design that is unbalanced the predicted regression line using all data will differ from that predicted from one using average data.

## DESCRIPTION OF DATA SETS

The data sets used in the statistical analyses to examine whether HiTEC 3000 causes or contributes to the failure of emission control systems were generated from raw data supplied to SAI (as Lotus 123 spreadsheets) by the mileage accumulation test laboratories. The data sets were constructed sequentially, each data set being a subset of the previous data set. The data sets created and the emissions tests excluded at each step are as follows:

- ETHYL0S Data set as received from the mileage accumulation test laboratory. No records are excluded, except one test for the replacement vehicle designated D3A: the single test of D3A at 15,554 miles (initial mileage upon receipt). All tests of the replacement car with the old car's emissions control system (labeled as D3A) are included.
- ETHYL1S All zero-mile tests are excluded, as per 40 CFR 86.088-28(a)(4)(i)(A)(1).
- ETHYL2S All tests that are invalid from an engineering point of view and therefore considered to be "justifiable drops" are excluded. These include the 1,000 mile tests conducted at Automotive Testing Laboratories whose exclusion is justifiable on both statistical and engineering grounds (See Appendix I and Attachment F). Also dropped in this data set are all measurements from vehicle D3A.
- ETHYL3S Tests preceding unscheduled maintenance tests are excluded per 40 CFR 86.088-28.
- ETHYL4S Extra tests beyond the standard two tests are excluded. If these tests were included, the variance calculations for the statistical tests would be biased. These are the tests that were performed because the results from the first two tests were considered to be too discrepant. In the

majority of instances the mileage intervals have only two tests per vehicle. In data set ETHYL3S, for example, only about 25 percent of the testing intervals have extra tests. There are three types of exceptions to this use of only two tests at each mileage interval. First, at scheduled maintenance (35,000 miles and 60,000 miles for model group D; 30,000 miles and 60,000 miles for all other model groups), emissions were tested before and after maintenance; thus for these intervals there are typically four tests (two before and two after maintenance). Second, tests performed after unscheduled maintenance are considered separately from tests at the required mileage intervals. For example, vehicle H1 has four tests at the 40,000 mile interval — two for the unscheduled maintenance at 37,826 miles and two for the regular 40,000 mile tests. Third, tests were performed before and after 50,000 mile component changes. At this mileage point there are typically four tests (two before and two after component changes).

On October 12, 1989 a meeting was held in Washington, D.C. with representatives from the EPA's Office of Mobile Sources to review the statistical analysis work that had been completed to date. At that meeting a presentation was made and discussion held on the relevant sections of the Code of Federal Regulations, the data sets generated, and the justification for dropping data points based on the interpretation of the CFR. Following this review, the EPA indicated that the approach taken seemed "reasonable".

#### ADDITIONAL DATA SETS FOR 75,000 MILE ACCUMULATION

As mentioned above, the original design of the HiTEC 3000 testing program called for only 50,000 accumulated miles and emissions testing in accordance with current requirements under Section 211(f) of the Clean Air Act. The scope of the testing program was increased to include 75,000 miles of vehicle operation in light of the ongoing debate concerning reauthorization of the Act.

Because of the change in mileage accumulation, certain aspects of the testing program that had been completed needed to be reviewed to insure that the data past

50,000 miles would be internally consistent with data up to and including 50,000 miles. The aspect that most obviously demanded evaluation was the component changes that had occurred at 50,000 miles. As discussed earlier, these changes were made to determine what effects on tailpipe emissions were the result of the deterioration of components up to 50,000 miles. An analysis of the data following the 50,000 mile component changes indicated that, in general, statistically significant increases in emissions from vehicles occur about as frequently as statistically significant decreases in emissions; however some changes were substantially larger than others (see Attachment G). For example, in model group D a very large and statistically significant decrease in CO emissions occurred with both fuel types. Further, the vehicles in this model group fueled with HiTEC 3000 also exhibited a statistically significant decrease in HC emissions after component changes. In addition, in model groups G and H, increases in HC and CO emissions from vehicles using HiTEC 3000 were found to be statistically significant, while increased emissions from vehicles using the clear fuel (Howell EEE) were nonsignificant. These changes can be seen in the data plots in Attachment B.

The change in mileage accumulation scope also required reevaluation of tester bias. As discussed previously, most of the pre-50,000 mile tests at ECS were performed by one individual. Tests after 50,000 miles were conducted by other ECS testers while the original tester was on sick leave. This change raised the question of whether emission test results were affected in any way by the use of several testers. If a tester bias did exist, it would be more difficult to estimate how much of the variance between results was associated with the fuel type as opposed to the tester. Again, an analysis was conducted to determine if tester choice had statistically significant effects on test results. For example, a statistical test was performed on model group D for HC. The results from this test, as well as those for other model groups, are reported in Attachment H and indicate that statistically significant differences from the original tester are evident in many model groups and for all three pollutants.

In order to properly and consistently analyze all of the data from the mileage accumulation program to 75,000 miles, three new data sets were created from data set ETHYL4S. These data sets, which are adjusted for component change and tester effects, are as follows:

- ETHYL4S2** The two emissions tests performed after the component changes at 50,000 miles are deleted for all vehicles in the program. The tests performed before component changes are retained.
- ETHYL4S3** Adjustments for component changes are calculated from the statistical analysis discussed in Attachment G (the effect for each pollutant/fuel/model combination is calculated separately as the mean effect across vehicles) for all measurements past 50,000 miles.
- ETHYL4S4** Adjustments for tester effects at ECS Laboratories are added to all measurements after 50,000 miles in data set ETHYL4S2. Details of the analysis are provided as Attachment H.

The main data set for assessing the effects of HiTEC 3000 is ETHYL4S2; a complete listing of this data set is provided as Attachment A. Some analysis was repeated on ETHYL4S, ETHYL4S3, and ETHYL4S4, with little change in results or interpretation. The results are described in detail in Section 4.

The numbers of emissions tests read, kept, and dropped in each data set are shown below:

<u>Data Set</u>	<u>Read</u>	<u>Kept</u>	<u>Dropped</u>
ETHYL0S	2605	2604	1
ETHYL1S	2604	2440	164
ETHYL2S	2440	2304	136
ETHYL3S	2304	1965	339
ETHYL4S	1965	1814	151
ETHYL4S2	1814	1712	102

## Data Set ETH4SPRG

1

OBS	Model	Vehicle ID	Fuel	Mileage	HC (g/mi)	CO (g/mi)	NOx (g/mi)
1	D	D2	EEE	45,094	0.658	5.322	0.469
2	D	D4	HT3	35,161	0.645	3.505	0.427
3	D	D4	HT3	40,133	0.616	4.162	0.413
4	D	D4	HT3	44,786	0.580	4.908	0.416
5	D	D4	HT3	50,166	0.581	3.490	0.417
6	D	D4	HT3	50,184	0.607	3.619	0.384
7	D	D5	HT3	35,049	0.579	4.459	0.452
8	D	D5	HT3	45,151	0.740	4.943	0.551
9	D	D5	HT3	48,433	0.924	4.960	0.441
10	D	D5	HT3	48,444	0.796	4.617	0.404
11	D	D6	HT3	35,152	0.550	3.979	0.437
12	D	D6	HT3	45,113	0.646	5.790	0.480
13	D	D6	HT3	49,985	0.680	6.173	0.476
14	E	E2	EEE	45,090	0.266	6.490	0.415
15	E	E2	EEE	50,181	0.323	7.928	0.531
16	E	E3	EEE	30,048	0.175	4.573	0.291
17	E	E5	HT3	40,048	0.214	4.963	0.424
18	E	E6	HT3	50,040	0.199	6.250	0.396
19	F	F1	HT3	49,943	0.688	1.747	0.582
20	F	F1	HT3	75,099	0.698	1.067	0.607
21	F	F2	HT3	30,401	0.571	1.240	0.640
22	F	F2	HT3	45,067	0.608	1.251	0.764
23	F	F2	HT3	50,040	0.614	1.364	1.173
24	F	F3	HT3	15,118	0.392	0.757	0.727
25	F	F3	HT3	45,128	0.610	1.274	0.687
26	F	F3	HT3	67,052	0.578	1.623	0.840
27	F	F3	HT3	67,070	0.573	1.248	0.764
28	F	F4	EEE	1,045	0.169	0.398	0.485
29	F	F4	EEE	45,052	0.745	2.897	1.060
30	F	F4	EEE	45,070	0.651	2.413	1.390
31	F	F4	EEE	50,126	0.668	2.830	1.442
32	F	F4	EEE	55,006	0.653	4.909	1.808
33	F	F5	EEE	50,118	0.596	2.253	0.978
34	F	F5	EEE	50,166	0.618	1.939	1.037
35	F	F5	EEE	66,536	0.515	2.284	1.097
36	F	F5	EEE	66,554	0.482	2.131	1.141
37	F	F6	EEE	30,170	0.645	1.878	0.816
38	F	F6	EEE	34,995	0.505	1.518	0.699
39	F	F6	EEE	45,216	0.700	2.145	0.779
40	F	F6	EEE	50,042	0.715	2.470	0.870
41	T	T1	HT3	24,968	0.383	3.843	0.508
42	T	T1	HT3	45,004	0.417	5.017	0.536
43	T	T1	HT3	50,078	0.516	6.576	0.665
44	T	T2	EEE	45,124	0.381	4.400	0.579
45	T	T2	EEE	50,044	0.491	6.735	0.873
46	T	T3	EEE	25,004	0.300	3.718	0.707
47	T	T3	EEE	50,037	0.420	6.710	0.801
48	T	T4	HT3	1,149	0.188	1.555	0.488
49	T	T4	HT3	5,273	0.248	2.632	0.465
50	T	T5	HT3	24,994	0.360	4.172	0.430
51	T	T5	HT3	40,082	0.441	5.648	0.596
52	T	T6	EEE	5,215	0.224	1.992	1.034
53	C	C1	EEE	20,090	0.243	2.233	0.373

## Data Set ETH4SPRG

2

OBS	Model	Vehicle ID	Fuel	Mileage	HC (g/mi)	CO (g/mi)	NOx (g/mi)
54	C	C1	EEE	35,135	0.156	1.916	0.301
55	C	C1	EEE	35,165	0.149	1.954	0.320
56	C	C2	HT3	20,090	0.198	2.160	0.314
57	C	C2	HT3	30,100	0.206	2.644	0.185
58	C	C2	HT3	30,180	0.209	3.360	0.234
59	C	C2	HT3	50,059	0.221	4.004	0.379
60	C	C2	HT3	60,123	0.206	2.979	0.546
61	C	C3	HT3	15,064	0.258	2.911	0.229
62	C	C3	HT3	20,059	0.199	2.118	0.246
63	C	C3	HT3	25,073	0.249	3.308	0.437
64	C	C3	HT3	30,060	0.240	3.382	0.266
65	C	C3	HT3	30,131	0.182	2.102	0.238
66	C	C3	HT3	35,058	0.260	2.629	0.181
67	C	C3	HT3	35,112	0.269	2.129	0.193
68	C	C3	HT3	40,064	0.240	3.064	0.200
69	C	C3	HT3	50,058	0.251	2.956	0.290
70	C	C3	HT3	65,056	0.254	3.244	0.307
71	C	C4	EEE	20,074	0.202	1.708	0.446
72	C	C4	EEE	35,059	0.156	1.849	0.414
73	C	C5	EEE	20,066	0.159	2.277	0.228
74	C	C5	EEE	45,060	0.173	2.327	0.248
75	C	C6	HT3	20,065	0.237	2.417	0.259
76	C	C6	HT3	30,073	0.194	2.126	0.233
77	C	C6	HT3	40,086	0.192	2.199	0.250
78	C	C6	HT3	50,060	0.171	1.953	0.235
79	C	C6	HT3	55,082	0.162	2.228	0.323
80	C	C6	HT3	60,050	0.186	2.333	0.296
81	G	G1	EEE	5,080	0.091	0.981	0.223
82	G	G1	EEE	51,110	0.137	3.234	0.395
83	G	G1	EEE	55,064	0.106	2.465	0.361
84	G	G1	EEE	63,738	0.216	2.632	0.343
85	G	G1	EEE	63,757	0.182	2.222	0.326
86	G	G1	EEE	65,120	0.175	2.637	0.346
87	G	G1	EEE	65,139	0.164	2.518	0.317
88	G	G2	EEE	40,112	0.213	2.194	0.363
89	G	G2	EEE	55,067	0.129	2.408	0.389
90	G	G2	EEE	60,085	0.109	2.543	0.402
91	G	G3	HT3	51,110	0.183	2.248	0.390
92	G	G3	HT3	60,060	0.178	2.883	0.401
93	G	G4	EEE	51,104	0.132	2.194	0.365
94	G	G5	HT3	51,132	0.283	2.192	0.357
95	G	G5	HT3	60,124	0.153	2.140	0.422
96	G	G6	HT3	51,118	0.169	2.350	0.369
97	G	G6	HT3	55,065	0.174	2.026	0.352
98	G	G6	HT3	55,439	0.121	1.262	0.319
99	G	G6	HT3	55,466	0.074	1.352	0.266
100	G	G6	HT3	55,491	0.121	1.660	0.381
101	G	G6	HT3	60,064	0.187	1.709	0.386
102	G	G6	HT3	65,061	0.191	2.946	0.367
103	H	H1	EEE	30,063	0.281	3.671	0.347
104	H	H1	EEE	55,068	0.327	4.883	0.338
105	H	H1	EEE	55,094	0.481	5.067	0.405
106	H	H1	EEE	55,113	0.417	4.760	0.398

## Data Set ETH4SPRG

3

OBS	Model	Vehicle ID	Fuel	Mileage	HC (g/mi)	CO (g/mi)	NOX (g/mi)
107	H	H1	EEE	55,131	0.436	4.712	0.397
108	H	H2	EEE	20,059	0.241	3.097	0.345
109	H	H2	EEE	30,108	0.350	4.169	0.308
110	H	H2	EEE	30,161	0.321	3.724	0.325
111	H	H2	EEE	35,099	0.317	3.974	0.311
112	H	H2	EEE	50,095	0.374	5.004	0.458
113	H	H2	EEE	55,119	0.339	4.964	0.436
114	H	H2	EEE	75,128	0.373	3.801	0.414
115	H	H3	HT3	20,091	0.230	2.108	0.544
116	H	H3	HT3	30,146	0.247	2.707	0.438
117	H	H3	HT3	45,058	0.305	3.858	0.376
118	H	H3	HT3	50,107	0.335	3.625	0.387
119	H	H3	HT3	55,101	0.356	5.103	0.301
120	H	H4	HT3	20,063	0.249	2.190	0.673
121	H	H4	HT3	45,061	0.305	4.443	0.476
122	H	H4	HT3	55,075	0.321	4.145	0.326
123	H	H5	EEE	30,109	0.228	2.347	0.451
124	H	H5	EEE	30,225	0.229	2.380	0.509
125	H	H5	EEE	55,063	0.336	5.179	0.429
126	H	H6	HT3	30,127	0.381	4.469	0.303
127	H	H6	HT3	40,063	0.323	3.885	0.331
128	H	H6	HT3	45,088	0.420	4.126	0.271
129	H	H6	HT3	50,159	0.358	4.867	0.379
130	H	H6	HT3	50,688	0.428	4.908	0.388
131	H	H6	HT3	55,058	0.467	5.027	0.267
132	I	I1	EEE	25,093	0.170	2.282	0.353
133	I	I1	EEE	50,110	0.180	2.779	0.384
134	I	I1	EEE	50,379	0.167	2.768	0.438
135	I	I2	HT3	5,845	0.204	2.561	0.266
136	I	I2	HT3	15,301	0.178	2.237	0.505
137	I	I2	HT3	15,334	0.233	3.496	0.510
138	I	I2	HT3	30,066	0.200	2.615	0.349
139	I	I2	HT3	30,166	0.181	2.317	0.350
140	I	I2	HT3	50,278	0.212	2.401	0.301
141	I	I3	EEE	25,075	0.178	2.157	0.374
142	I	I4	HT3	30,067	0.215	1.766	0.291
143	I	I4	HT3	45,061	0.156	1.966	0.311
144	I	I4	HT3	50,431	0.158	2.329	0.311
145	I	I5	EEE	25,072	0.179	2.460	0.395
146	I	I5	EEE	35,076	0.181	2.224	0.333
147	I	I5	EEE	50,386	0.176	2.240	0.428
148	I	I6	HT3	35,064	0.186	1.965	0.361
149	I	I6	HT3	35,908	0.236	2.446	0.374
150	I	I6	HT3	40,066	0.193	2.082	0.333
151	I	I6	HT3	50,326	0.182	2.123	0.604

## Data Set ETH2SPRG

1

OBS	Model	Vehicle ID	Fuel	Mileage	HC (g/mi)	CO (g/mi)	NOx (g/mi)
1	D	D3	EEE	7,486	0.394	1.723	0.317
2	D	D3	EEE	7,502	0.408	2.063	0.292
3	D	D3	EEE	9,833	0.380	2.683	0.330
4	D	D3	EEE	9,851	0.385	2.379	0.325
5	D	D3	EEE	15,157	0.419	2.694	0.328
6	D	D3	EEE	15,175	0.519	3.289	0.319
7	D	D3	EEE	15,202	0.527	3.469	0.412
8	D	D3	EEE	19,801	0.707	4.178	0.319
9	D	D3	EEE	19,820	0.616	3.658	0.239
10	D	D3	EEE	19,854	0.563	3.376	0.281
11	D	D3	EEE	24,944	0.955	4.614	0.369
12	D	D3	EEE	24,961	0.685	4.248	0.301
13	D	D3	EEE	24,980	0.778	4.273	0.323
14	D	D3	EEE	25,007	0.569	4.139	0.340
15	D	D3	EEE	25,024	0.612	3.836	0.340
16	D	D3	EEE	29,758	0.583	4.353	0.295
17	D	D3	EEE	29,777	0.588	3.909	0.316
18	D	D3	EEE	29,795	0.487	3.608	0.260
19	D	D3	EEE	29,814	0.649	3.995	0.321
20	D	D3	EEE	29,832	0.563	4.023	0.324
21	D	D3	EEE	34,842	0.565	4.816	0.361
22	D	D3	EEE	34,859	0.596	6.233	0.403
23	D	D3	EEE	34,877	0.613	5.466	0.424
24	D	D3	EEE	39,786	0.600	6.777	0.400
25	D	D3	EEE	39,804	0.543	5.490	0.386
26	D	D3	EEE	39,823	0.589	5.853	0.441
27	D	D3	EEE	44,794	0.561	4.912	0.332
28	D	D3	EEE	44,813	0.596	5.576	0.375
29	D	D3	EEE	50,076	0.652	6.022	0.411
30	D	D3	EEE	50,095	0.706	5.858	0.354
31	D	D3	EEE	50,114	0.615	5.477	0.372
32	D	D3	EEE	50,132	0.619	6.039	0.433
33	D	D3	EEE	50,147	0.747	5.464	0.387
34	D	D3	EEE	50,249	0.564	4.427	0.370
35	D	D3	EEE	50,267	0.525	3.691	0.367
36	D	D3	EEE	50,285	0.535	3.802	0.383
37	D	D3	EEE	50,302	0.545	3.509	0.365
38	D	D3	EEE	54,891	0.613	4.808	0.365
39	D	D3	EEE	54,910	0.483	4.280	0.370
40	D	D3	EEE	59,969	0.742	6.805	0.563
41	D	D3	EEE	59,988	0.761	7.304	0.577
42	D	D3	EEE	60,006	0.601	5.774	0.382
43	D	D3	EEE	60,024	0.555	4.942	0.303
44	D	D3	EEE	64,963	0.741	7.397	0.422
45	D	D3	EEE	64,982	0.677	7.247	0.466
46	D	D3	EEE	69,971	0.663	5.742	0.417
47	D	D3	EEE	69,990	0.564	4.953	0.367
48	D	D3	EEE	74,769	0.624	5.333	0.394
49	D	D3	EEE	74,787	0.682	4.961	0.336
50	D	D3	EEE	74,806	0.711	5.449	0.394
51	D	D3	EEE	74,824	0.653	4.560	0.398
52	E	E6	HT3	35,025	0.267	5.229	.
53	F	F1	HT3	50,086	0.719	1.576	0.632

## Data Set ETH2SPRG

OBS	Model	Vehicle ID	Fuel	Mileage	HC (g/mi)	CO (g/mi)	NOx (g/mi)
54	C	C1	EEE	1,053	0.129	1.917	0.164
55	C	C1	EEE	1,081	0.128	1.836	0.207
56	C	C1	EEE	1,099	0.150	1.328	0.210
57	C	C1	EEE	1,119	0.180	1.842	0.221
58	C	C1	EEE	1,184	0.133	1.311	0.148
59	C	C2	HT3	1,051	0.134	1.912	0.165
60	C	C2	HT3	1,072	0.115	1.712	0.160
61	C	C2	HT3	1,091	0.133	1.380	0.190
62	C	C2	HT3	1,118	0.172	1.702	0.232
63	C	C2	HT3	30,070	0.207	2.452	0.191
64	C	C2	HT3	30,100	0.206	2.664	0.185
65	C	C3	HT3	1,058	0.173	2.989	0.199
66	C	C3	HT3	1,078	0.141	2.353	0.240
67	C	C3	HT3	1,097	0.146	2.272	0.166
68	C	C3	HT3	1,137	0.156	1.807	0.199
69	C	C3	HT3	1,157	0.157	1.781	0.244
70	C	C4	EEE	1,050	0.145	1.937	0.125
71	C	C4	EEE	1,069	0.139	2.034	0.155
72	C	C4	EEE	1,089	0.120	1.808	0.200
73	C	C4	EEE	1,139	0.134	1.164	0.187
74	C	C4	EEE	1,155	0.133	1.041	0.245
75	C	C5	EEE	1,054	0.166	2.619	0.156
76	C	C5	EEE	1,081	0.136	1.956	0.130
77	C	C5	EEE	1,100	0.154	2.739	0.141
78	C	C5	EEE	1,120	0.156	1.948	0.178
79	C	C5	EEE	1,140	0.148	2.109	0.151
80	C	C6	HT3	981	0.166	2.152	0.179
81	C	C6	HT3	1,008	0.118	1.830	0.204
82	C	C6	HT3	1,028	0.132	1.843	0.175
83	C	C6	HT3	1,076	0.144	1.565	0.212
84	G	G1	EEE	1,030	0.090	0.870	0.158
85	G	G1	EEE	1,059	0.114	1.109	0.169
86	G	G1	EEE	1,091	0.127	2.145	0.161
87	G	G2	EEE	1,038	0.084	0.698	0.169
88	G	G2	EEE	1,079	0.080	0.898	0.162
89	G	G2	EEE	5,034	0.190	1.179	0.223
90	G	G2	EEE	30,143	0.128	2.321	0.394
91	G	G2	EEE	35,041	0.129	3.034	0.451
92	G	G3	HT3	1,041	0.086	0.801	0.185
93	G	G3	HT3	1,069	0.085	0.724	0.197
94	G	G3	HT3	30,116	0.235	1.662	0.350
95	G	G4	EEE	1,063	0.103	0.980	0.153
96	G	G4	EEE	1,090	0.079	0.695	0.136
97	G	G5	HT3	1,116	0.094	0.971	0.223
98	G	G5	HT3	1,143	0.090	1.052	0.217
99	G	G5	HT3	40,008	0.230	2.567	0.326
100	G	G5	HT3	45,006	0.212	2.711	0.326
101	G	G5	HT3	50,009	0.168	4.321	0.391
102	G	G6	HT3	1,087	0.084	0.953	0.209
103	G	G6	HT3	1,117	0.122	0.716	0.177
104	G	G6	HT3	45,039	0.175	3.055	0.382
105	G	G6	HT3	50,009	0.187	3.168	0.447
106	H	H1	EEE	1,048	0.126	1.130	0.435

## Data Set ETH2SPRG

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OBS	Model	Vehicle ID	Fuel	Mileage	HC (g/mi)	CO (g/mi)	NOx (g/mi)
107	H	H1	EEE	1,087	0.162	1.749	0.449
108	H	H2	EEE	1,083	0.202	1.863	0.353
109	H	H2	EEE	1,103	0.208	1.830	0.372
110	H	H3	HT3	1,026	0.144	1.262	0.320
111	H	H3	HT3	1,075	0.165	1.585	0.349
112	H	H4	HT3	1,162	0.142	1.412	0.581
113	H	H4	HT3	1,182	0.165	1.646	0.549
114	H	H5	EEE	1,021	0.143	1.680	0.457
115	H	H5	EEE	1,056	0.154	1.692	0.395
116	H	H6	HT3	1,082	0.157	1.622	0.503
117	H	H6	HT3	1,101	0.158	1.618	0.431
118	I	I1	EEE	1,033	0.151	2.089	0.305
119	I	I1	EEE	1,072	0.151	2.136	0.411
120	I	I2	HT3	1,079	0.181	2.519	0.380
121	I	I2	HT3	1,098	0.168	2.251	0.399
122	I	I2	HT3	25,007	0.449	4.273	0.449
123	I	I2	HT3	25,032	0.317	3.142	0.486
124	I	I2	HT3	25,058	0.211	2.991	0.488
125	I	I3	EEE	1,038	0.179	2.095	0.167
126	I	I3	EEE	1,058	0.198	2.184	0.191
127	I	I4	HT3	1,034	0.133	1.489	0.178
128	I	I4	HT3	1,054	0.164	2.036	0.173
129	I	I4	HT3	25,008	0.374	3.117	0.384
130	I	I4	HT3	25,039	0.180	2.046	0.377
131	I	I4	HT3	25,067	0.302	2.754	0.350
132	I	I4	HT3	50,123	0.382	3.069	0.338
133	I	I5	EEE	1,065	0.139	1.694	0.383
134	I	I5	EEE	1,085	0.145	2.025	0.389
135	I	I6	HT3	1,060	0.122	1.702	0.275
136	I	I6	HT3	1,080	0.152	1.916	0.223